

Iteroparity in Columbia River summer steelhead: Summary of kelt survival and transportation studies

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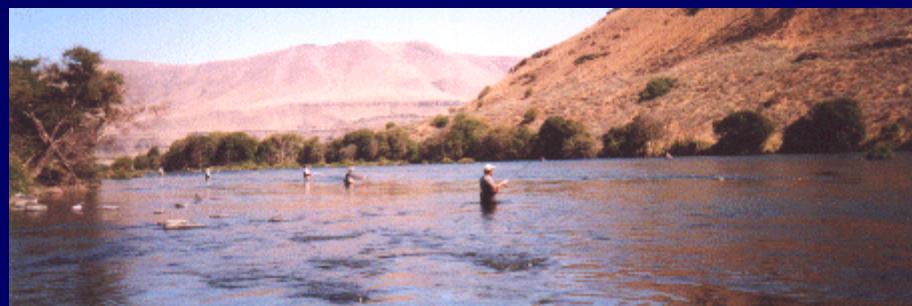


Introduction

- ▶ Iteroparity (repeat spawning) provides genetic and demographic benefits
- ▶ Increasing iteroparity rates is a potential steelhead recovery tool
 - Kelt reconditioning
 - Kelt transportation
- ▶ Very little is known about historic or potential COLR steelhead iteroparity

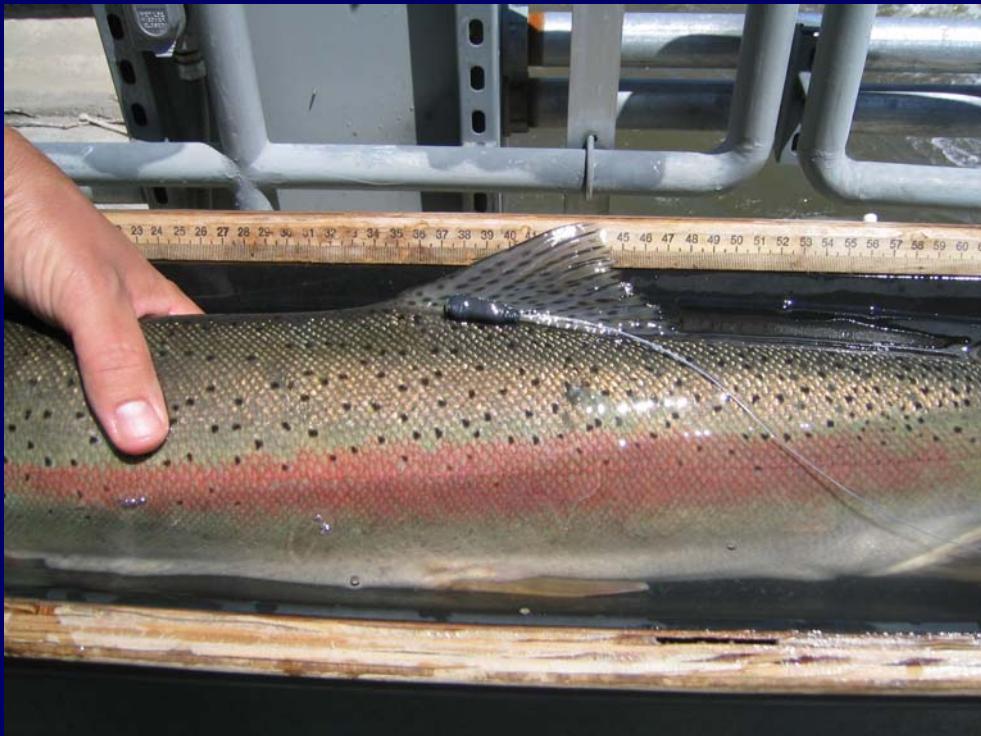
Study Objectives

- ▶ Collect baseline iteroparity data for Snake and Columbia populations
 - Return rates
 - Life history (migration timing, breeding interval)
- ▶ Evaluate kelt transportation
- ▶ Monitor downstream migration



Methods

- Collect adult steelhead in bypass systems
- Use ultrasound to identify kelts
- PIT and/or radio tag kelts
- Assign to in-river or transport treatments
- Monitor behaviors and return rates



Kelt Sampling

<u>Dam</u>	<u>Adults</u>		<u>% Kelts</u>	<u>Sampling years</u>			
	<u>Examined</u>	<u>Kelts</u>		<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>
John Day	4,394	3,560	81%	x	x	x	x
McNary	1,390	1,141	82%	x	x		x
L. Granite	7,409	7,068	95%		x	x	x
Total	13,193	11,769					

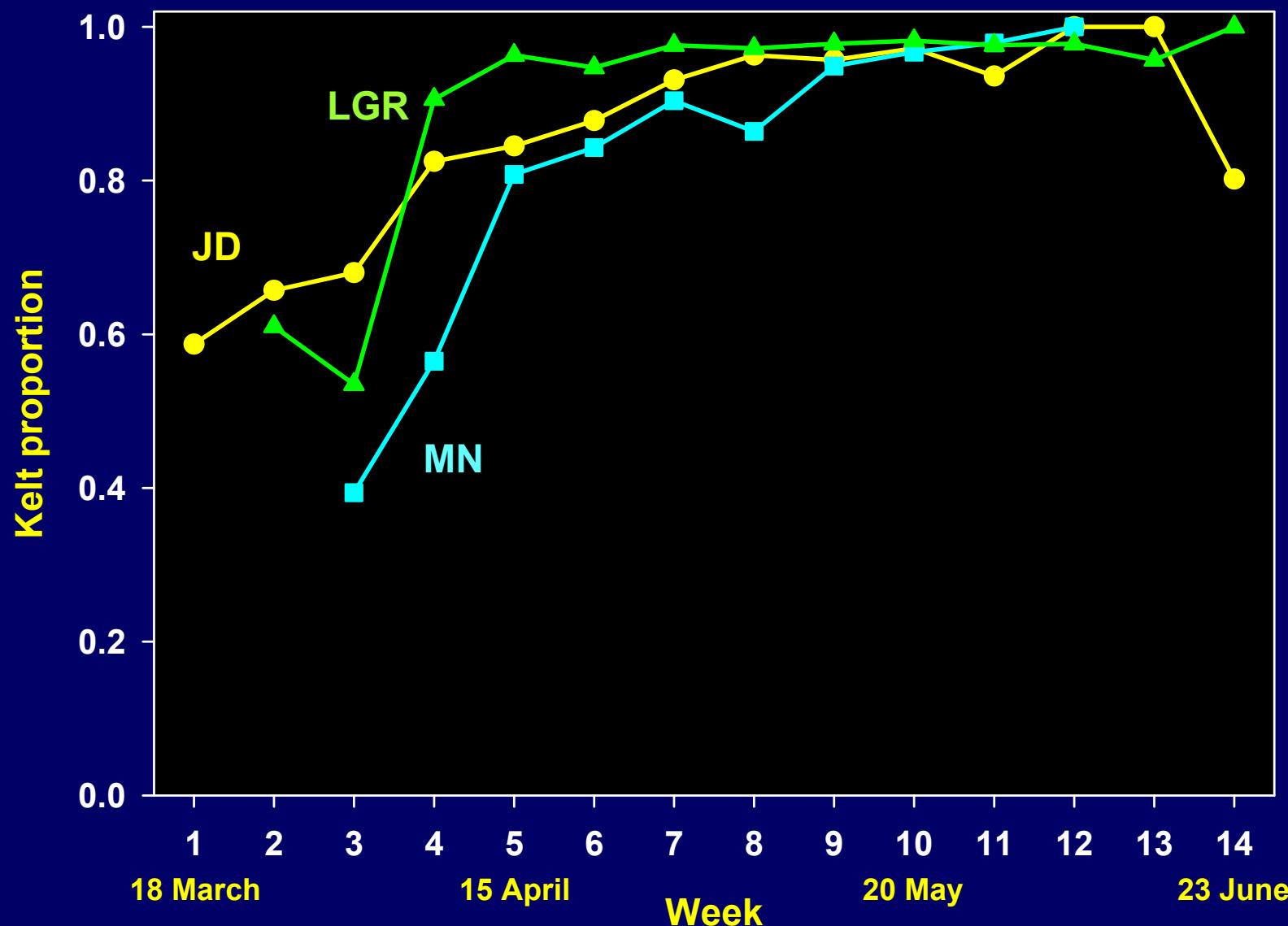


'Good' condition kelt

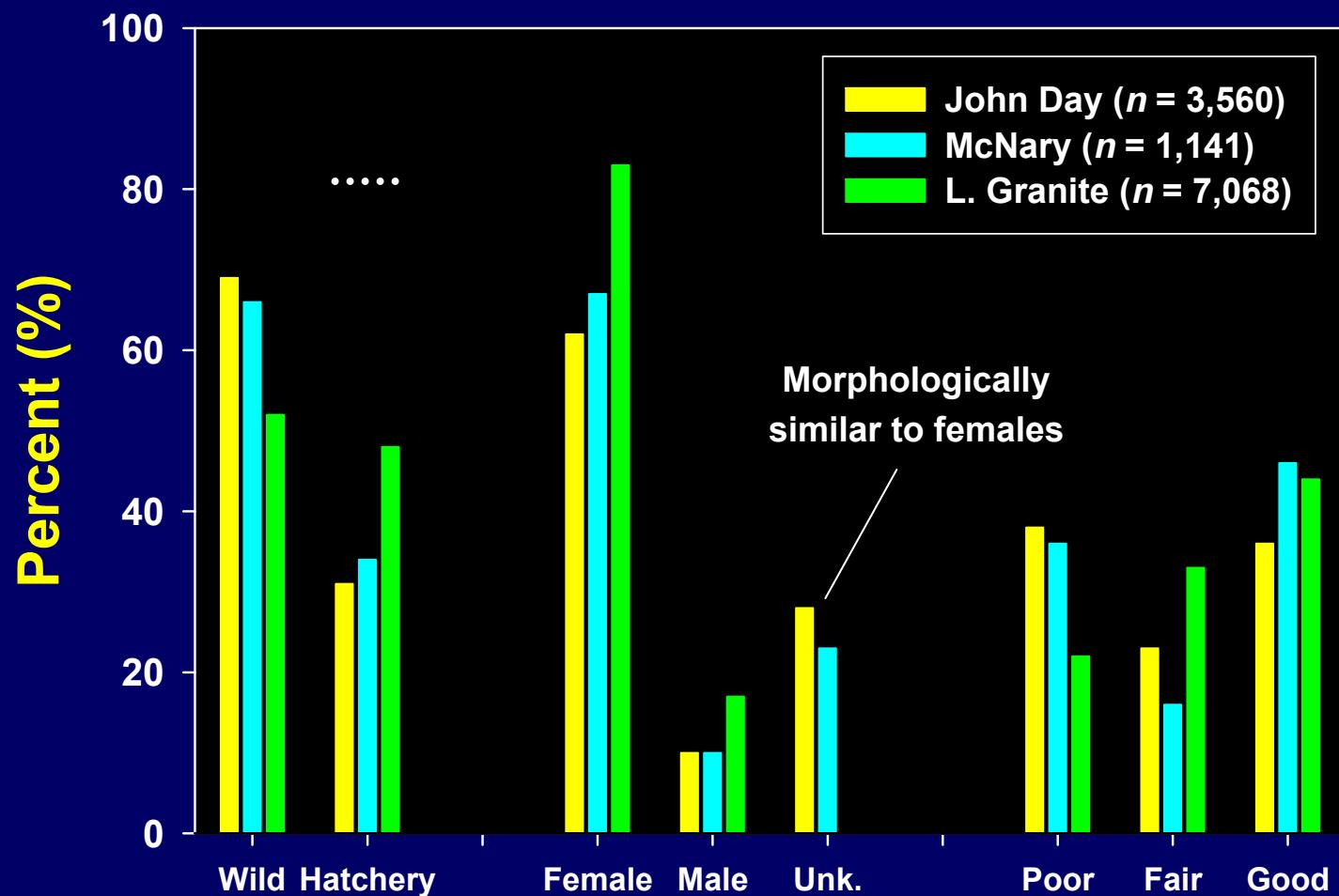


. . . not so good

Kelt Sampling



Kelt Sampling ($n = 11,769$)



Kelt Tagging

<u>John Day</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>Total</u>
Sampled	1,096	1,188	669	607	3,560
In-River PIT	485	520	451	490	1,946
In-River radio	113	15		388	516
Transport PIT		287			287

Transport (truck) evaluation

Kelt Tagging

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<u>McNary</u>	<u>2001</u>	<u>2002</u>	<u>2004</u>	<u>Total</u>
Sampled	330	650	161	1,141
In-River PIT	67	406	126	599
In-River radio	18	299	120	437

Kelt Tagging

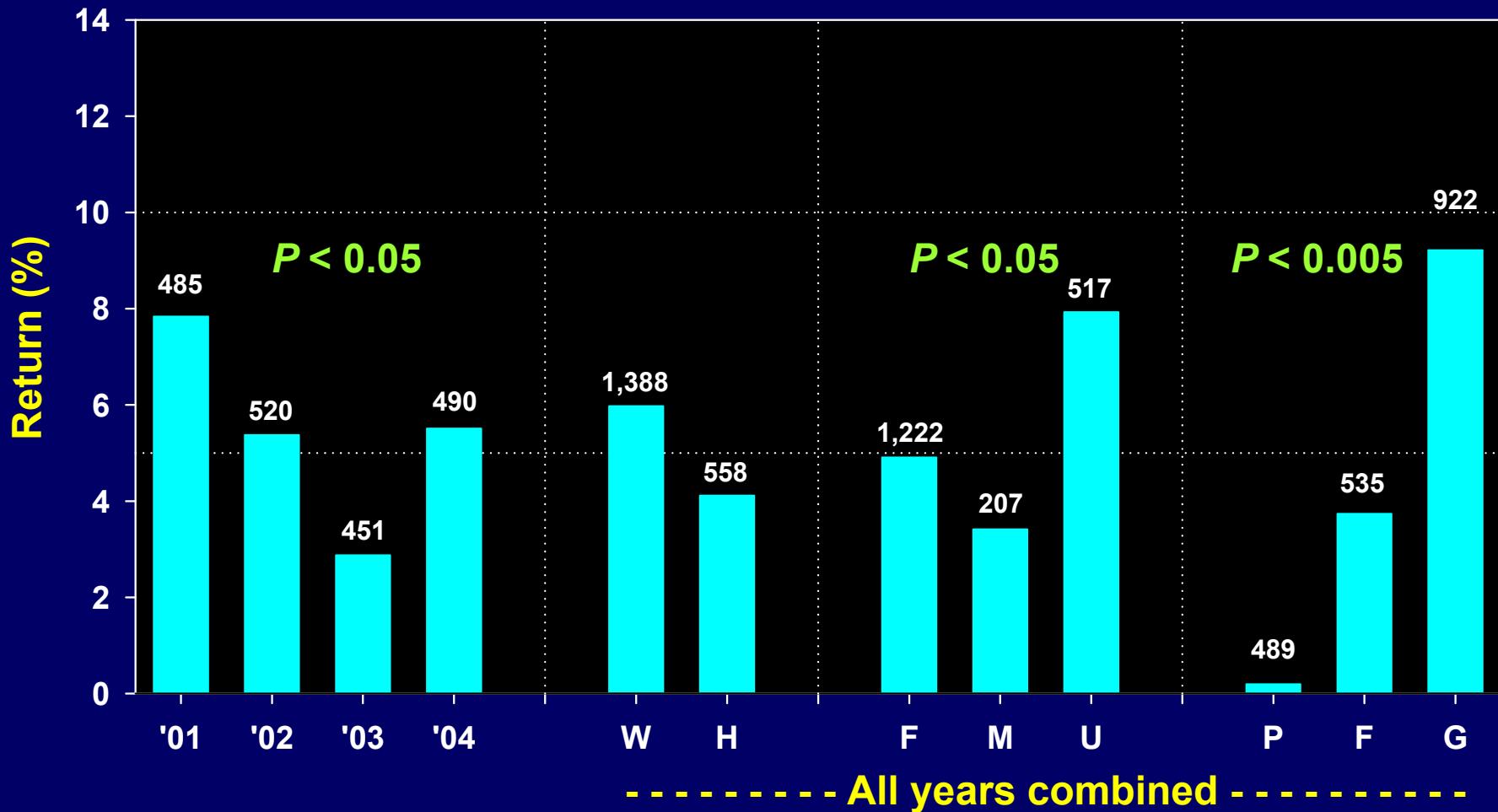
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In-River PIT	67	406	126	599
In-River radio	18	299	120	437

<u>Lower Granite</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>Total</u>
Sampled	2,610	1,714	2,744	7,068
In-River PIT	1,617	868	1,277	3,762
In-River radio	208	211	5	424
Transport PIT	750	376	984	2,110

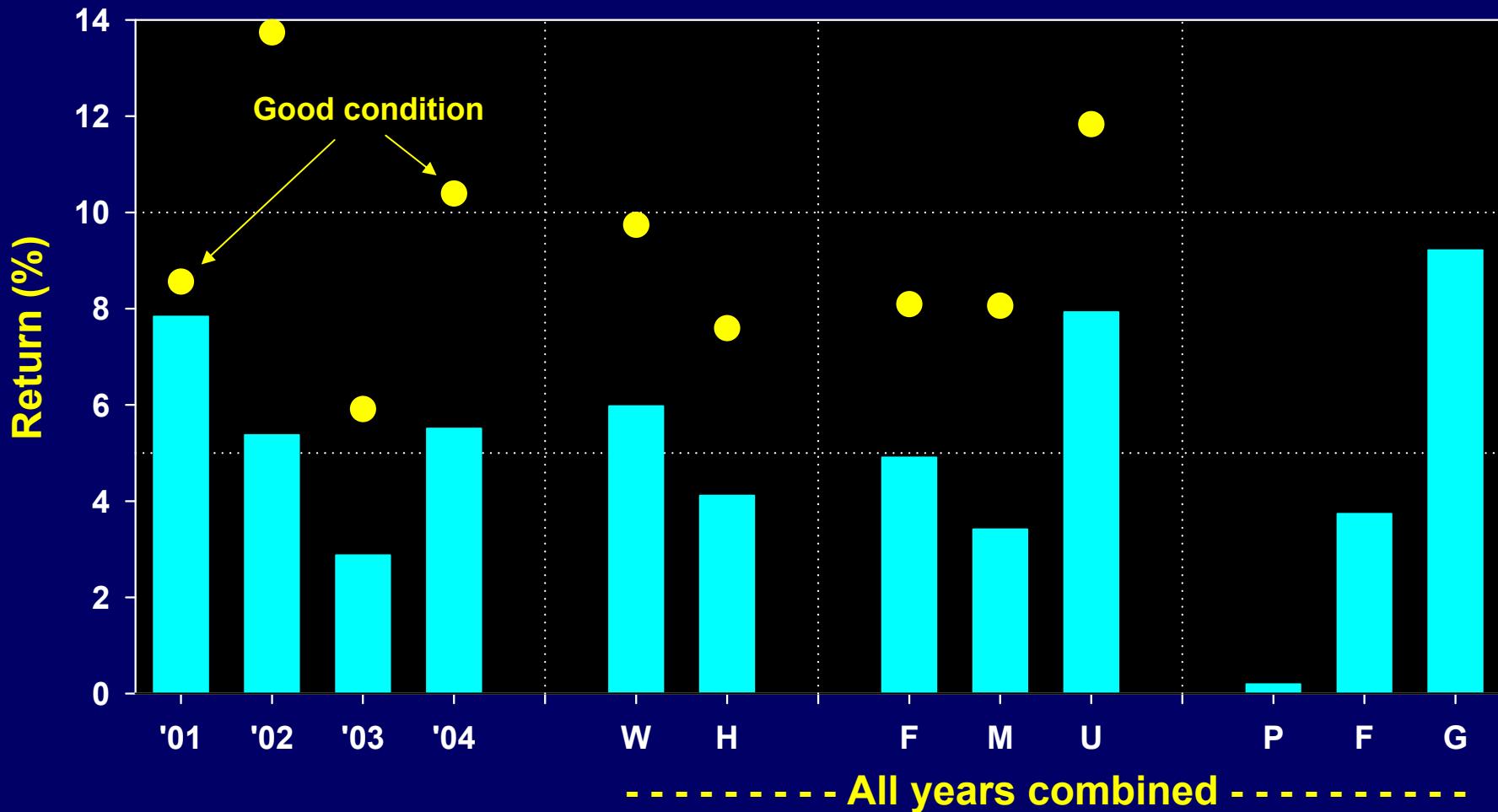
Barge
Eval

Repeat spawner returns: John Day (In-River)



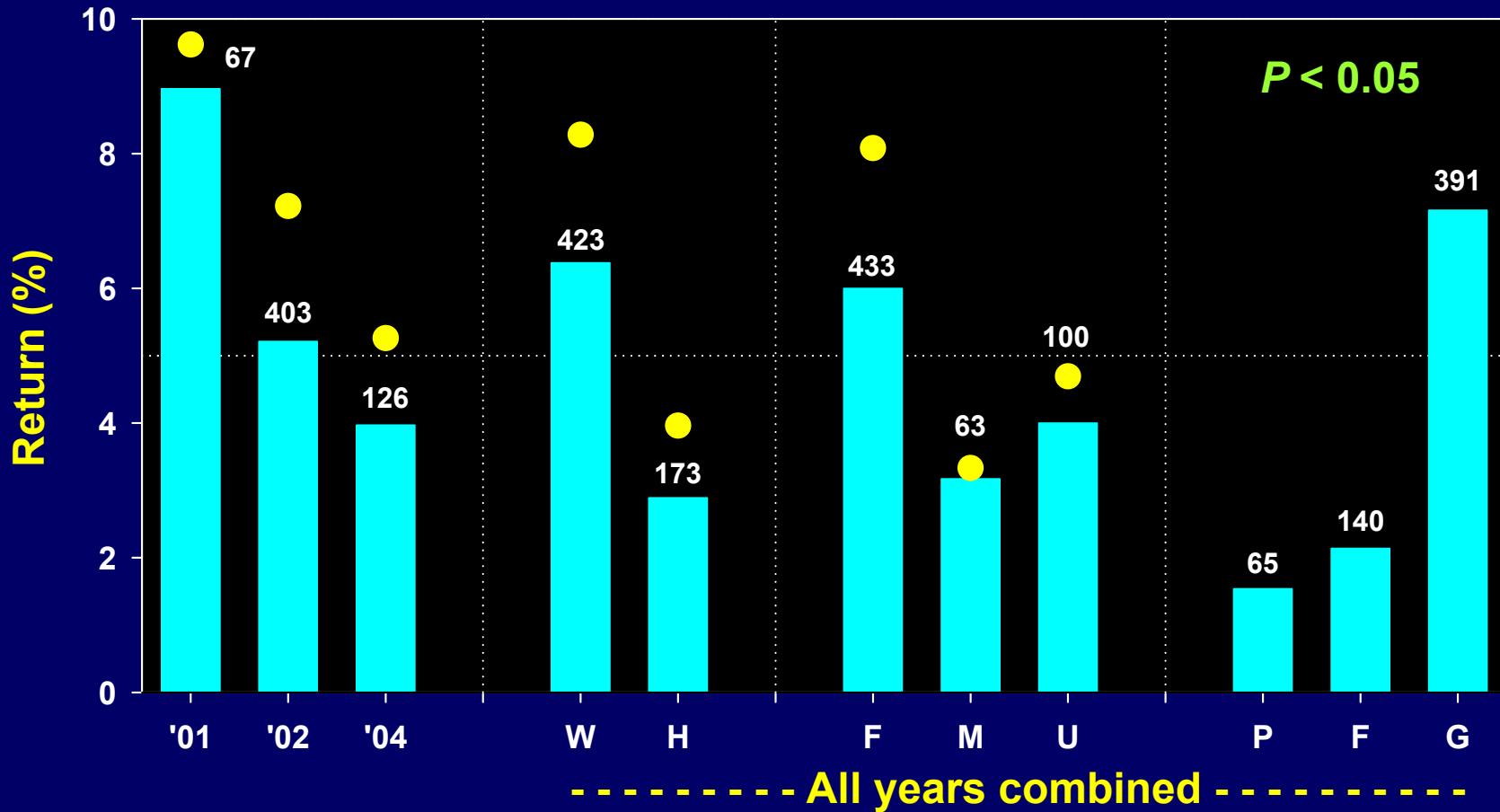
- 1 poor condition kelt returned (2002, wild, female)

Repeat spawner returns: John Day (In-River)

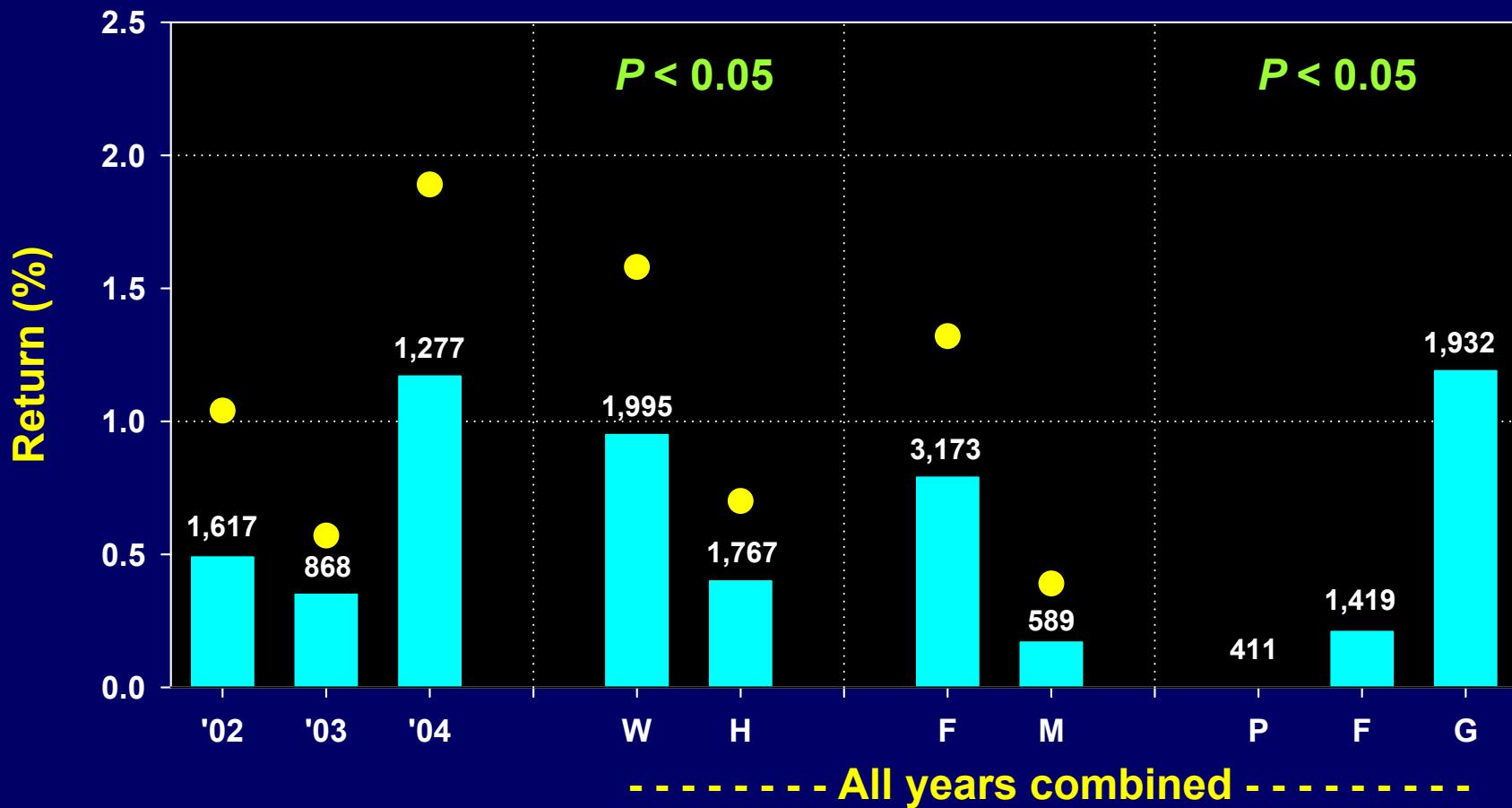


► 1 poor condition kelt returned (2002, wild, female)

Repeat spawner returns: McNary (In-River)



Repeat spawner returns: L. Granite (In-River)



- 1 male kelt returned (2004, wild, good condition)

Statistics (In-River)

<u>Effect</u>	<u>df</u>	<u>Chi-sq</u>	<u>P</u>	<u>Odds ratio (95% ci)</u>
Tagsite (JD v. LGr) (MN v. LGr)	2	48.8	<0.001	5.88 (3.73-9.67) 3.94 (2.23-6.97)
Condition (Good v. Poor) (Fair v. Poor)	2	32.0	<0.001	25.36 (6.10-105.43) 10.27 (2.40-43.84)
Week	1	20.3	<0.001	0.85 (0.79-0.91)
Color (Dark v. Bright) (Int. v. Bright)	2	9.9	0.007	0.22 (0.05-0.97) 0.60 (0.42-0.87)
Origin (Hatchery v. Wild)	1	8.2	0.004	0.56 (0.37-0.83)
Year	3	7.7	0.052	
Sex (Male v. Female) (Unk. v. Female)	2	3.3	0.195	0.65 (0.30-1.39) 1.29 (0.87-1.90)
Length	1	1.8	0.186	0.98 (0.96-1.01)

Transportation Summary (John Day)

<u>John Day</u>	<u>In-River</u>	<u>Transport</u>	
All Fish	10.3% (271)	11.9% (287)	
Male	9.1% (33)	0.0% (19)	
Female	11.2% (161)	11.2% (206)	All $P > 0.10$
Unsexed	9.1% (77)	17.7% (62)	
Hatchery	10.0% (120)	6.4% (110)	
Wild	10.6% (151)	15.3% (177)	

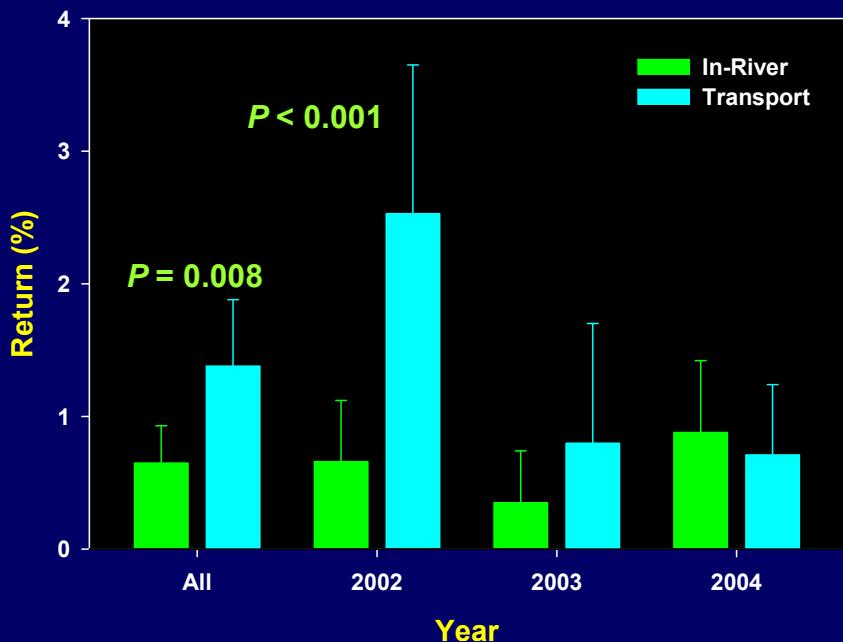
Benefits of trucking kelts was unclear
in this small sample

Multiple regression results
also inconclusive



Transportation Summary (L. Granite)

All good and fair fish



	<u>In-River</u>	<u>Transport</u>
Male	0.21% (474)	0.31% (320)
Female *	0.73% (2,738)	1.57% (1,788)
Hatchery *	0.34% (1,472)	1.23% (977)
Wild	0.92% (1,740)	1.50% (1,131)

	<u>In-River</u>	<u>Transport</u>
Fair	0.15% (1,347)	0.11% (924)
Good **	1.02% (1,865)	2.36% (1,184)

* $P < 0.05$; ** $P < 0.005$

Transportation Summary (L. Granite)

Multiple logistic regression* results for transport effects:

	<u>P</u>	<u>Odds ratio (95% ci)</u>
All fish	0.004	2.30 (1.30-4.08)
Females only	0.004	2.34 (1.31-4.20)
Good condition only	0.003	2.49 (1.38-4.50)
Hatchery only	0.008	2.30 (1.45-11.90)

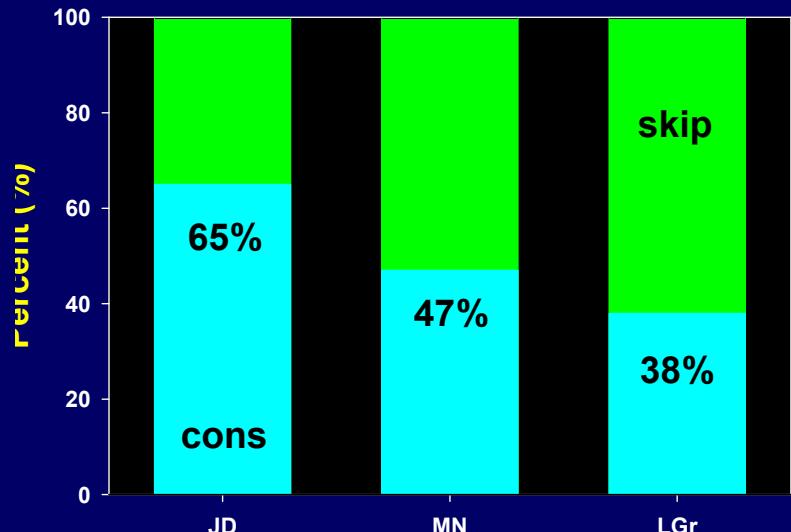
* Models included: year, length, sex, origin, condition, migration timing (early v. late)

Barged kelts > twice as likely to return,
after other variables controlled for

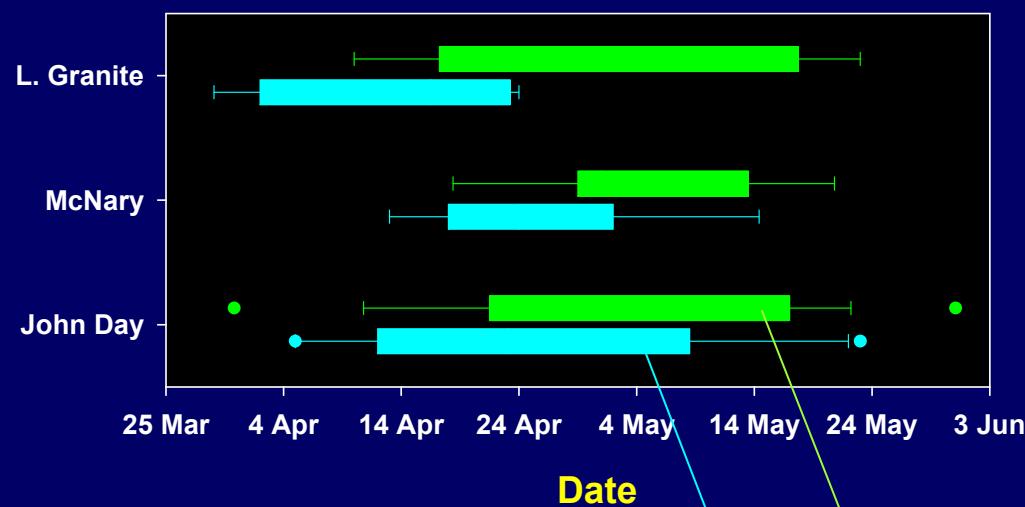


Repeat Spawner Life History

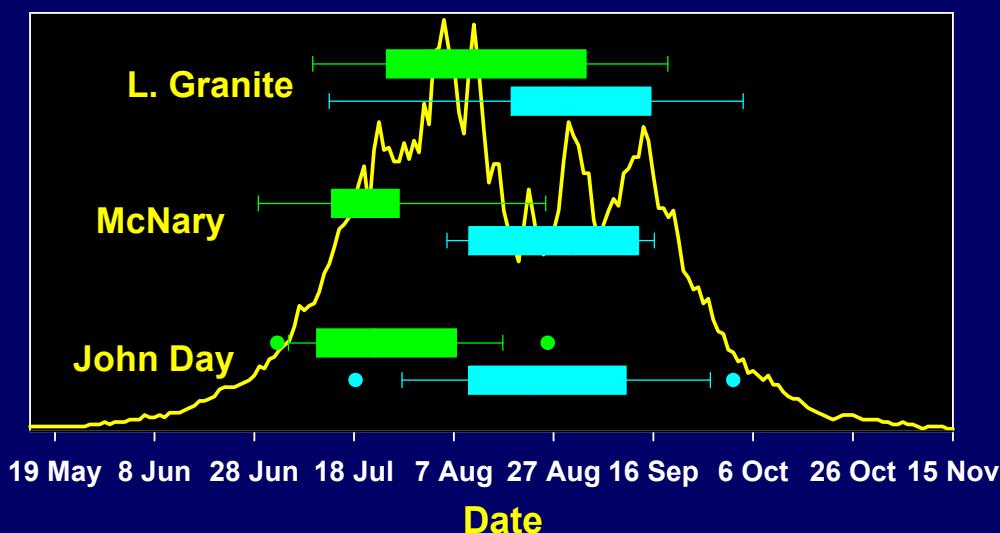
Consecutive vs skip spawners



Outmigration timing



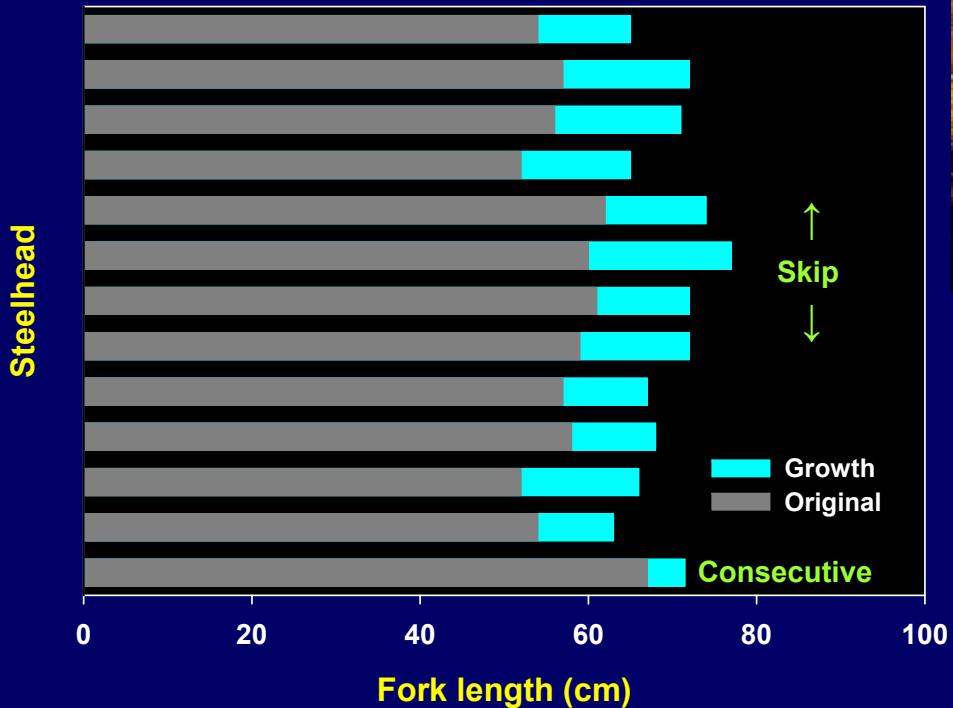
Return migration timing



Consecutive
Skip

Repeat Spawner Life History

13 recaptured spawners

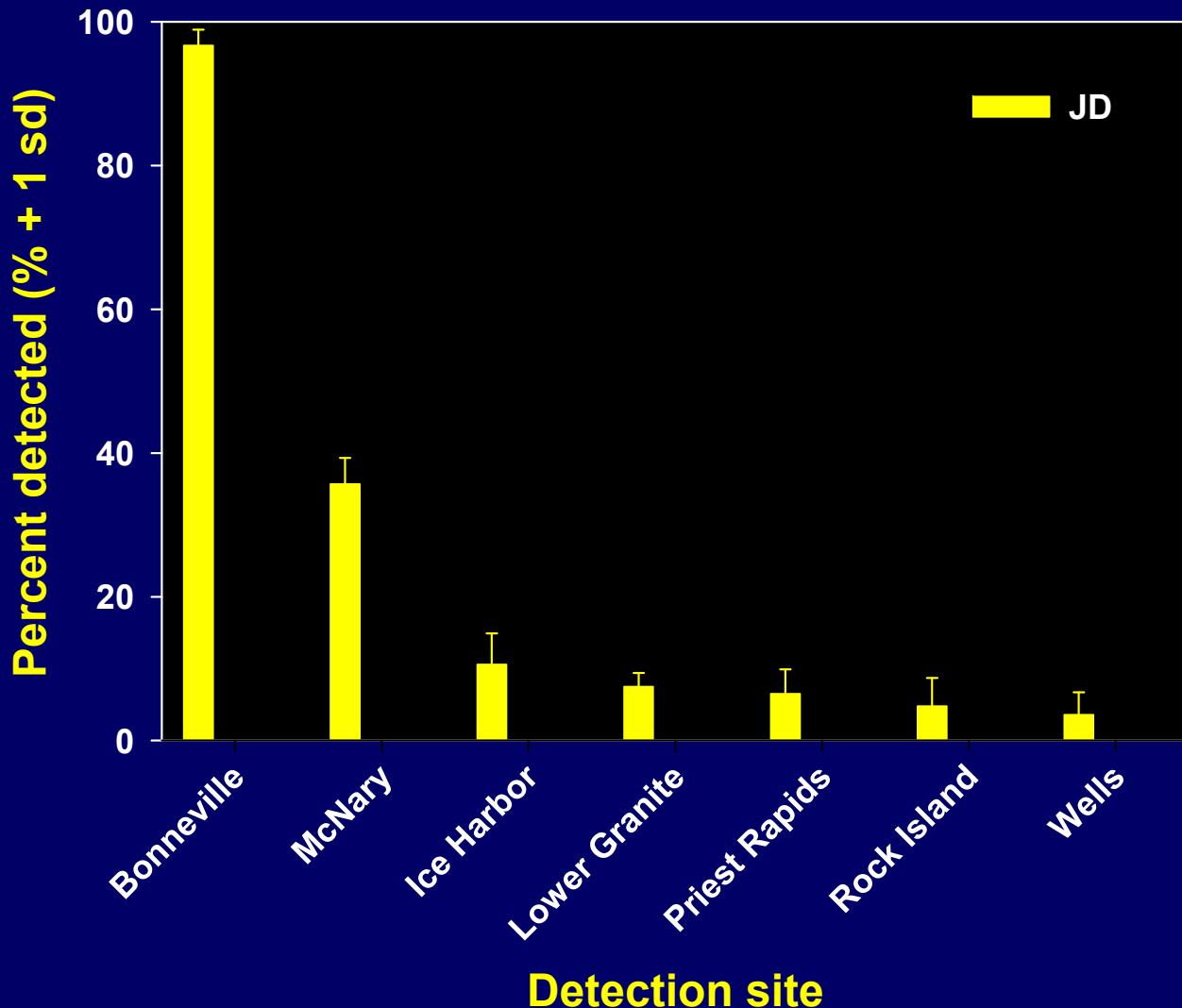


◀ Mean growth = 12 cm (skips)
(22%)

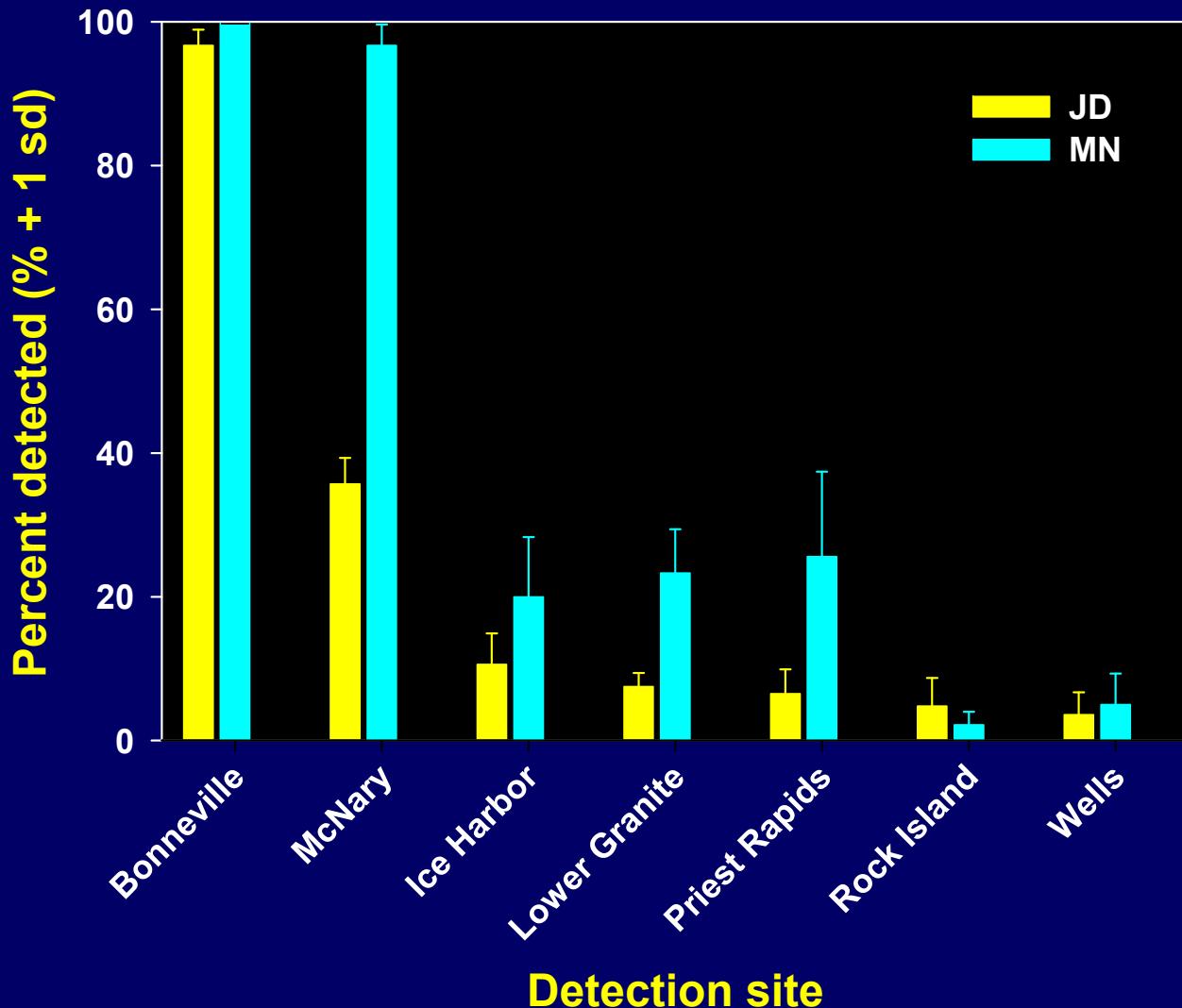
► 3-time spawners

$n = 2$ (0.03% of full sample; 0.10% of John Day sample)

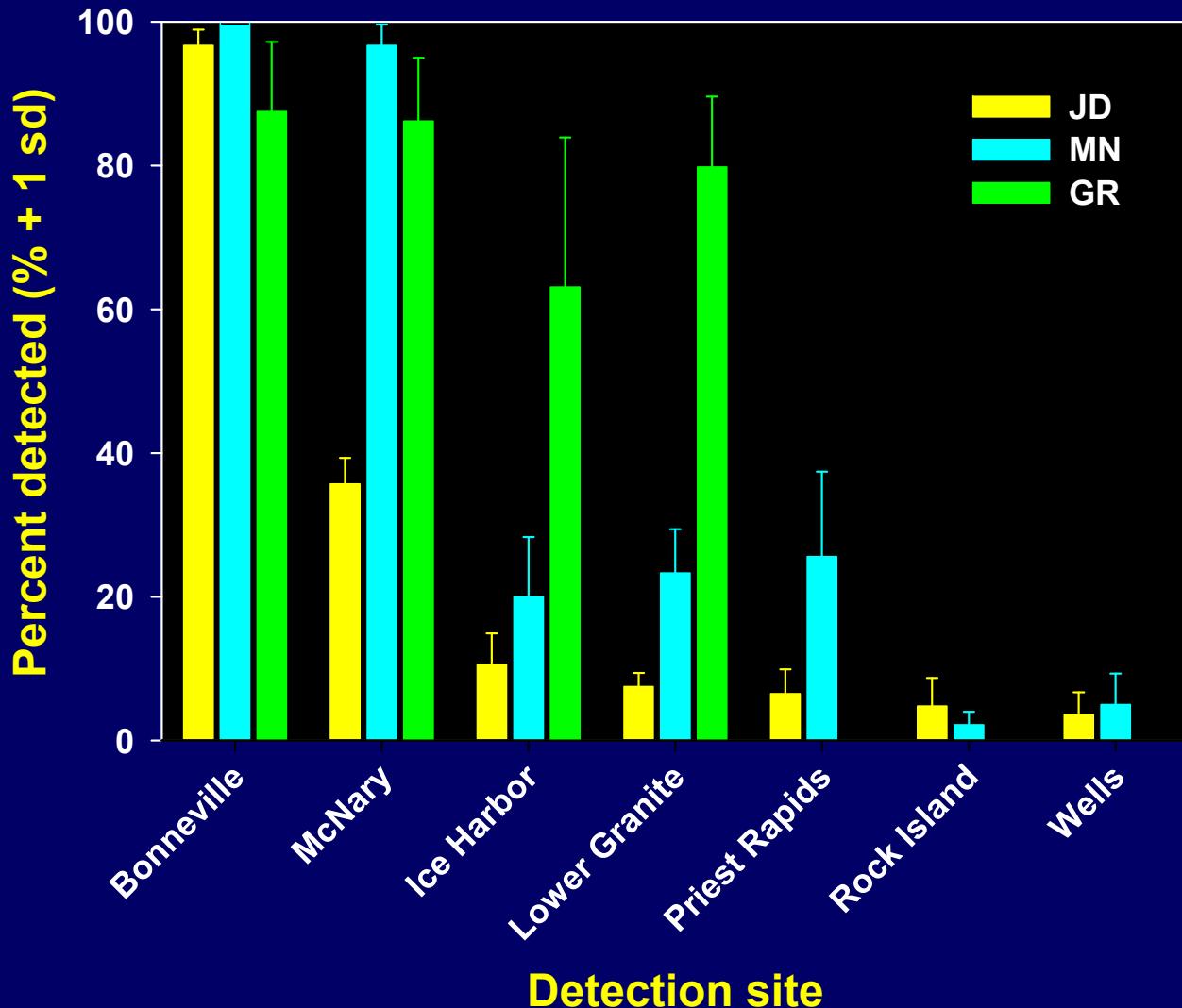
Repeat Spawner Detections



Repeat Spawner Detections

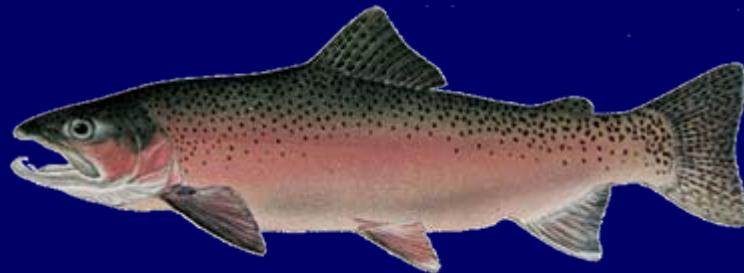


Repeat Spawner Detections



Summary

- ▶ Aggregate iteroparity estimates for in-river samples:
 - All fish: 5.5% (John Day), 5.4% (McNary), 0.7% (L. Granite)
 - ‘Good’ fish: 9.2% (John Day), 7.2% (McNary), 1.2% (L. Granite)
- ▶ Most likely to return:
 - Wild, female, good condition
 - Early outmigrants, relatively smaller
- ▶ Barging from L. Granite modestly improved returns
- ▶ Improved understanding of life history
 - Breeding interval
 - Migration timing
- ▶ Contributions of repeat spawners
 - 10s – 100s of Snake River fish
 - 100s – 1000s of Columbia River fish
- ▶ Continuing analyses: effects of river and ocean conditions



A photograph of a person fly fishing in a river. The water is clear, showing a rocky bed. A fishing rod is visible on the left, and a landing net is partially submerged in the water on the left side. The background shows a rocky bank with some vegetation.

Questions?